WHAT IS CLAIMED IS:

Sub A1

1. A method for forming an interlayer insulating film comprising the steps of:

forming a film containing B (boron), C (carbon) and H_2O on a substrate (by plasma enhanced chemical vapor deposition using a source gas containing an Si-C-O-H compound, an oxidative gas and a compound containing B (boron); and

annealing said film, releasing C (carbon) and H_2O contained in said film from said film, and thereby forming said film into a porous SiO_2 film containing B (boron).

2. A method according to claim 1, wherein said oxidative gas is any one of O_2, O_3 and H_2O.

3. A method according to claim 1, wherein an inert gas is added to said source gas.

4. A method according to claim 3, wherein said inert gas is Ar.

5. A method according to claim 1, wherein said annealing is performed by O (oxygen) plasma.

Sub A2

6. A method according to claim 1, wherein a temperature of said substrate for said annealing is higher than the temperature for forming said film containing B (boron), C (carbon) and OH.

7. A method according to claim 1, wherein said Si-C-O-H compound is one selected from the group consisting of compounds designated by a general formula $Si(OR)_nH_{4-n}$ ($R=CH_3$ or C_2H_5, $n=1$ to 3).

8. A method according to claim 1, wherein an

underlying insulating film is formed on said substrate, and said porous SiO_2 film is formed on said underlying insulating film.

9. A method according to claim 1, wherein said porous SiO_2 film is formed, and then said porous SiO_2 film is subjected to H (hydrogen) plasma treatment.

10. A method according to claim 1, further comprising the steps of:

forming said interlayer insulating film on said substrate and then forming a damascene trench in said interlayer insulating film;

forming a side wall insulating film on sides of said damascene trench;

embedding a metal film in said damascene trench; and

forming a barrier metal layer on said metal film.

11. A method according to claim 10, wherein said side wall insulating film is formed by the steps of:

forming said damascene trench and then forming a first insulating film on said interlayer insulating film, on the sides of said damascene trench and on a bottom of said damascene trench; and

anisotropically etching said first insulating film to such an extent that said first insulating film formed on the sides of said damascene trench remains and said first insulating film formed on the bottom of said damascene trench is removed.

12. A method according to claim 1, further comprising

the steps of:

forming said interlayer insulating film on said substrate and then forming a damascene trench in said interlayer insulating film;

forming a barrier metal layer on the sides and bottom of said damascene trench;

embedding a metal film in said damascene trench; and

forming an anti-oxidizing film on said metal film.

13. A method according to claim 1, wherein said interlayer insulating film is formed, and then a cover insulating film is formed on said interlayer insulating film.

14. A method for forming an interlayer insulating film comprising:

a first step of forming a film containing a C-O-H polymer on a substrate by plasma enhanced chemical vapor deposition using a source gas containing an Si-C-O-H compound and H_2; and

a second step of annealing said film, releasing the C-O-H polymer contained in said film from said film, and thereby forming a porous SiO_2 film on said substrate.

15. A method according to claim 14, wherein said first step and said second step are alternately repeated.

16. A method according to claim 14, wherein O_2 is added to said source gas.

17. A method according to claim 14, wherein an inert gas is added to said source gas.

18. A method according to claim 17, wherein said inert

gas is Ar.

19. A method according to claim 14, wherein said annealing is performed by O (oxygen) plasma.

20. A method according to claim 14, wherein a temperature of said substrate for said annealing is higher than the temperature for forming said film containing the C-O-H polymer.

21. A method according to claim 14, wherein said Si-C-O-H compound is one selected from the group consisting of compounds designated by a general formula $Si(OR)_nH_{4-n}$ ($R=CH_3$ or C_2H_5, $n=1$ to 3).

22. A method according to claim 14, wherein an underlying insulating film is formed on said substrate, and said porous SiO_2 film is formed on said underlying insulating film.

23. A method according to claim 14, wherein said porous SiO_2 film is formed, and then said porous SiO_2 film is subjected to H (hydrogen) plasma treatment.

24. A method according to claim 14, further comprising the steps of:

forming said interlayer insulating film on said substrate and then forming a damascene trench in said interlayer insulating film;

forming a side wall insulating film on sides of said damascene trench;

embedding a metal film in said damascene trench; and

forming a barrier metal layer on said metal film.

25. A method according to claim 24, wherein said side wall insulating film is formed by the steps of:

forming said damascene trench and then forming a first insulating film on said interlayer insulating film, on the sides of said damascene trench and on a bottom of said damascene trench; and

anisotropically etching said first insulating film to such an extent that said first insulating film formed on the sides of said damascene trench remains and said first insulating film formed on the bottom of said damascene trench is removed.

26. A method according to claim 14, further comprising the steps of:

forming said interlayer insulating film on said substrate and then forming a damascene trench in said interlayer insulating film;

forming a barrier metal layer on the sides and bottom of said damascene trench;

embedding a metal film in said damascene trench; and

forming an anti-oxidizing film on said metal film.

27. A method according to claim 14, wherein said interlayer insulating film is formed, and then a cover insulating film is formed on said interlayer insulating film.

28. An apparatus for forming an interlayer insulating film comprising:

a chamber for forming a film;

pipes for supplying a source gas to said chamber;

flow rate control means attached to said pipes, for controlling a flow rate of said source gas;

high-frequency power generating means for applying a high-frequency power to said chamber;

switching means for inputting or shutting off said high-frequency power applied to said chamber; and

control means for controlling said flow rate control means and said switching means.

29. An apparatus according to claim 28, wherein said control means controls said flow rate control means, thereby periodically changing the flow rate of said source gas.

30. An apparatus according to claim 28, wherein said control means controls said switching means, thereby periodically changing said high-frequency power applied to said chamber.

31. An apparatus according to claim 28, wherein said control means controls said flow rate control means and said switching means, thereby changing the flow rate of said source gas and said high-frequency power applied to said chamber in the same cycle and in the same phase.

32. An apparatus according to claim 28, wherein said source gas is one selected from the group consisting of a gas mixture of an Si-C-O-H compound and H_2; a gas mixture of an Si-C-O-H compound, H_2 and O_2; a gas mixture of an Si-C-O-H compound, H_2 and Ar; a gas mixture of an Si-C-O-H compound, H_2 and He; a gas mixture of an Si-C-O-H compound, H_2, O_2 and Ar; a gas mixture of an Si-C-O-H compound, H_2, O_2 and He; a

gas mixture of an Si-C-O-H compound and H_2O; a gas mixture of an Si-C-O-H compound, H_2O and Ar; and a gas mixture of an Si-C-O-H compound, H_2O and He.

33. A semiconductor device comprising an interlayer insulating film formed by a method for forming an interlayer insulating film according to claim 1.

34. A semiconductor device comprising an interlayer insulating film formed by a method for forming an interlayer insulating film according to claim 3.

35. A semiconductor device comprising an interlayer insulating film formed by a method for forming an interlayer insulating film according to claim 4.

36. A semiconductor device comprising an interlayer insulating film formed by a semiconductor manufacturing apparatus according to claim 28.

37. A semiconductor device comprising an interlayer insulating film formed by a semiconductor manufacturing apparatus according to claim 29.

38. A semiconductor device comprising an interlayer insulating film formed by a semiconductor manufacturing apparatus according to claim 30.

39. A semiconductor device comprising an interlayer insulating film formed by a semiconductor manufacturing apparatus according to claim 31.